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# Burden of infectious diseases in South Asia

Anita K M Zaidi, Shally Awasthi, H Janaka deSilva

Infectious diseases are a major cause of death in South Asia, with children incurring a disproportionate share of the burden. This review discusses the underlying causes of some of the more common diseases and strategies to improve their detection and control

Preventable infections are a major cause of deaths and disabilities in South Asia. Over two thirds of the estimated 3.7 million deaths in children in South Asia in the year 2000 were attributable to infections such as pneumonia, diarrhoea, and measles.<sup>1 2</sup> India now has the second largest population with AIDS and HIV infection in the world, and tuberculosis and chronic hepatitis continue to threaten the lives of millions. Of the overall burden of deaths related to infectious disease in the region, around 63% are in children aged under 5 years.<sup>3</sup> Serious effort should be devoted to the control of infectious disease if South Asian countries are to meet their millennium development goal of two thirds reduction in child mortality by 2015.

Sri Lanka alone among South Asian countries has made remarkable progress in reducing the burden of infectious disease, despite civil war and meagre resources.

This review describes the burden of infectious diseases of public health importance in South Asia, the underlying risk factors, and strategies to improve detection and control.

## Sources and selection criteria

We searched PubMed and the databases of the World Health Organization and Unicef for information on infectious diseases of public health importance in South Asia. We also reviewed the bibliographies of key references and reviews for relevant information.

## Risk factors for disease and death

People in South Asia are at a higher risk of developing infectious diseases and dying from their illness than people in industrialised countries.<sup>3</sup> The root causes are poverty and its associated problems of unhygienic living conditions, malnutrition, illiteracy, and poor access to clean water, toilet facilities, and quality health care.

In South Asian children, poor nutrition and deficiencies in micronutrients (vitamin A and zinc) are important underlying risk factors for death due to infectious diseases.<sup>4-6</sup> Around half of the children in South Asia are underweight or stunted, and malnutrition contributes to an estimated 55% of deaths in children.<sup>2-4</sup>

## Estimating the burden of disease

Evidence based decision making in health requires the availability of sound data, but good quality information on the occurrence of infectious diseases is unavailable from most of South Asia, especially on premature mortality and loss of healthy life years in adult populations. Thus calculations of disease burden using techniques such as disability adjusted life years

## Summary points

Acute respiratory infections, diarrhoea, and neonatal infections remain major child killers

India has the second highest burden of HIV and AIDS in the world, with 4.58 million people infected with HIV

Antibiotic misuse has resulted in high rates of antimicrobial resistance

Only half of all South Asian children receive routine immunisations, and many new vaccines have not been introduced in mass immunisation programmes

Lack of surveillance systems and poorly functioning public health systems hinder progress in infectious disease control in South Asia

Sri Lanka is the only country in South Asia which has developed and sustained a well functioning public health system, resulting in progress in control of infectious diseases

See editorial by  
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(DALYs) are fraught with difficulty; deaths and disability caused by infections such as meningitis, encephalitis, chronic hepatitis, leishmaniasis, congenital infections, rabies, and post-streptococcal rheumatic heart disease in South Asian populations remain hidden and unmeasured.

## Major child killers

### Acute respiratory infections and diarrhoea

Interventions targeted at diarrhoea and acute respiratory infections have resulted in substantial declines in deaths in South Asian children, although these diseases still account for almost half of the deaths (figure).<sup>7 2</sup> Many children do not receive timely and appropriate care (table 1). WHO and Unicef's strategy for reducing deaths due to these conditions is centred on the integrated management of childhood illness (IMCI) initiative—a holistic approach encompassing prevention, early detection, and treatment of common childhood infections in countries with limited resources.<sup>8</sup> Although South Asian countries have adopted the IMCI strategy in principle, implementation remains weak because of poorly functioning health systems and fragmented referral pathways. Use of vaccines against common pathogens of diarrhoea and pneumonia—rotavirus, pneumococcus, and

**Table 1** Selected indicators of infectious disease in South Asian children

Infectious disease	Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan	Sri Lanka
Acute respiratory infections:								
No of annual deaths*	60 240	82 320	—	576 480	—	18 240	135 600	<1000
% of children <5 years affected in previous two weeks†	—	18	—	19	70	34	24	—
% taken to health provider	—	27	—	64	40	18	53	—
Diarrhoea:								
No of annual deaths*	60 240	82 320	—	576 480	—	18 240	135 600	<1000
% of children <5 years affected in previous two weeks†	20	6	—	19	8	27	26	5
% receiving increased fluids plus continued feeding	33‡	61‡	—	27‡	—	11	19	34‡
Neonatal infections:								
Mortality per 1000 live births§	—	47	—	48	—	47	42	10
No of annual deaths¶	32 630	53 207	—	388 473	—	11 928	73 410	1133

Data sources: Unicef ([www.childinfo.org](http://www.childinfo.org)) and Hyder et al.<sup>11</sup>

\*Extrapolated from Black et al.<sup>2</sup>

†Before survey.

‡Data for oral rehydration therapy use only.

§Estimated for 1995.<sup>9</sup>

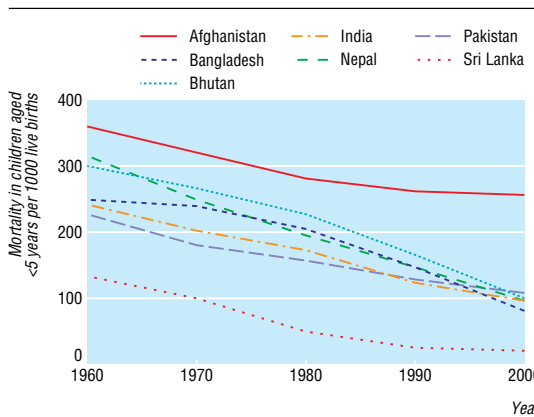
¶One third estimated to be due to neonatal infections. Data for Afghanistan are extrapolated.<sup>2</sup>

*Haemophilus influenzae* type b—has the potential to significantly reduce morbidity and mortality due to diarrhoea and acute respiratory infections.

### Neonatal infections

Neonatal infections are also a common cause of death in South Asia and are under-recognised as a public health problem. Regional neonatal mortality (deaths in the first 28 days of life) is 46.3 per 1000 live births, and an estimated 30-40% of these deaths are from infections<sup>9 10</sup>; 300 000 to 400 000 deaths in India alone each year can be attributed to neonatal infections (table 1). Determinants include lack of antenatal care and tetanus immunisation, unskilled birth attendants, unclean delivery practices and poor infection control, low birthweight babies, lack of exclusive breast feeding, and low levels of carer seeking for sick neonates.<sup>10-12</sup>

Integrated perinatal approaches based on solid evidence, similar to the IMCI initiative, are urgently needed to improve the survival of newborn babies in South Asia. Community based approaches to prevent and treat neonatal infections are especially important and are being tested in the field in several South Asian countries.<sup>12</sup>



Progress in survival of children aged under 5 years (per 1000 live births) in South Asian countries

### The challenge of HIV and AIDS and the control of tuberculosis

India is in the midst of an HIV and AIDS crisis, with over 4.58 million infected people, the highest burden in the world after South Africa.<sup>13</sup> Half a million people are projected to die from AIDS in India next year, and 600 000 are in urgent need of antiretroviral therapy.<sup>14</sup> Prevalence rates are lower in other South Asian countries but rising slowly, especially in Nepal and Pakistan (table 2).<sup>13 14</sup>

The prevalence of HIV in India is heterogeneous, the epidemic being concentrated in some (mainly) southern states while most of India has low rates of infection.<sup>14</sup> In the states with the highest prevalence (more than 1% of women presenting for antenatal check ups test positive for HIV antibodies)—Maharashtra, Tamil Nadu, Karnataka, Andhra Pradesh, Manipur, and Nagaland—public health systems are overwhelmed.<sup>14</sup> The pattern of spread is also diverse, with heterosexual transmission predominating in some areas and intravenous drug use in others. As a result, planning and implementing effective HIV prevention programmes pose a major challenge for Indian health officials. Locally relevant intervention programmes are urgently needed rather than a one size fits all approach. As a first step, behavioural surveillance programmes have been initiated in some areas in the Indian AIDS II project to improve understanding of transmission patterns.<sup>14</sup>

The presence of large numbers of people with AIDS in a region where tuberculosis is highly endemic creates a volatile situation for further spread of tuberculosis. South Asian countries are struggling to control tuberculosis through the implementation of WHO's directly observed therapy short course (DOTS) strategy. Although some progress has been made in expanding coverage, tuberculosis remains highly prevalent in most of South Asia, with Afghanistan having the highest rates (see table 2).<sup>15</sup> Pakistan has been particularly unsuccessful in its efforts at tuberculosis control, with only 24% of the population covered under the WHO's strategy, and low case notification rates.<sup>15</sup> Major constraints to tuberculosis control include weak public health infrastructure, staff shortages, inadequate funding, lack of awareness about the strategy among private practitioners, and multidrug resistant tuberculosis.<sup>15</sup>

**Table 2** Burden of HIV, AIDS, and tuberculosis in South Asian countries

Infectious disease	Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan	Sri Lanka
<b>HIV and AIDS</b>								
No affected	—	13 000	<100	4 580 000	<100	60 000	73 000*	4800
HIV prevalence in adults 15-49 years (%)	—	0.02	<0.01	0.8	<0.01	0.5	0.10	<0.10
Deaths from AIDS:								
Estimated in 2000	—	11 000	<100	350 000	<100	3,000	3500	500
Projected for 2005	—	17 000	<100	500 000	<100	6,000	11 000	1000
Antiretroviral therapy:								
No of people needing therapy in 2003	—	1800	14	600 000	14	8000	—	680
No of people receiving therapy in 2003	—	5	5	13 000	0	250	—	25
<b>Tuberculosis</b>								
Estimated incidence:								
No of cases†	314	233	—	178	—	201	171	58
No of new smear positive cases†	141	105	—	79	—	90	77	26
Notification rate†	21	29	—	38	—	58	7.5	23
Estimated % of new cases with multidrug resistance	7.3	1.4	—	3.4	—	—	9.6	—
Population coverage (%)‡	20	95	—	45	—	84	24	64

Data sources: WHO,<sup>13 15</sup> UNAIDS/WHO Global Report, 2000.<sup>15</sup>

\*Data available for 1999.<sup>14</sup>

†Per 100 000 population.

‡By WHO's directly observed therapy short course strategy.

## The unmeasured burden of malaria, typhoid, and dengue

Malaria and typhoid are among the common causes of febrile illness in children in South Asia. Outbreaks of mosquito borne dengue fever and dengue haemorrhagic disease are also increasingly reported.<sup>16</sup> Malaria is responsible for less than 5% of deaths in children in South Asia but is a serious contributor to morbidity and chronic anaemia.<sup>2</sup> Millions of South Asians have debilitating typhoid and dengue infections every year, but reliable data on the annual number of cases are hard to come by because these diseases require laboratory confirmation, which is not routinely attempted. Rates of typhoid fever as high as 980 per 100 000 population have been reported from urban slums in Delhi, and *Salmonella* is the commonest bacterial pathogen identified from bloodstream infections in South Asia.<sup>17-19</sup> Infection rates in children under 5 years of age are much higher than previously thought.<sup>17 19</sup> Public health approaches to infection control are needed, especially as drug resistant malaria and typhoid become increasingly common. An effective vaccine against *Salmonella typhi* is available but not included in routine childhood immunisations.

## The hepatitis B and C epidemics

High rates of hepatitis B infection in many South Asian countries are attributed to unsafe blood supply, reuse of contaminated syringes, lack of maternal screening to prevent perinatal transmission, and delay in the introduction of hepatitis B vaccine. India, Pakistan, and Bangladesh have the highest rates of infection, with prevalence ranging from 2% to 8% in different population groups.<sup>20</sup> Prevalence rates in Sri Lanka are under 1%.<sup>21</sup> Hepatitis C infections in South Asia are also rising, and chronic liver diseases increasingly burden the region's health systems.<sup>21 22</sup> Prevalence rates were estimated to be 1-2.4% in 1999.<sup>22</sup> Infections seem to be acquired at an early age, and reuse of contaminated syringes is strongly implicated in transmission of hepatitis B and hepatitis C infection.<sup>23 24</sup>

## Antimicrobial drug resistance and untreatable infections

Widespread resistance to commonly used, affordable antimicrobial agents in South Asia has made the treatment of infections such as pneumonia, dysentery, typhoid, malaria, neonatal sepsis, urinary tract infections, and tuberculosis challenging in resource limited environments.<sup>25 26</sup> For example, most pneumococci and *H influenzae* in South Asia are now resistant to cotrimoxazole, and fluoroquinolone resistance in *Salmonella* is rapidly increasing.<sup>25 27</sup> Many factors underlie increased antibiotic use and misuse in developing countries.<sup>26 28</sup> Infectious diseases are much more common, and appropriate microbiological facilities are rarely available or affordable, leading to empirical use of antibiotics for a wide range of illnesses. Antibiotics are freely available over the counter in South Asia, and self medication is common. Antibiotic misuse by unskilled practitioners is also rampant. Poor drug quality owing to use beyond expiry date, improper manufacture, or storage conditions may also contribute to resistance as subinhibitory levels of antibiotics can favour selection of resistant microbes.<sup>28</sup>

The optimum solution to the problem of antibiotic resistance remains investment in the infrastructure required to reduce the burden of infectious diseases. In the short term the best approaches rely on increasing awareness about antibiotic misuse, developing guidelines for practitioners in different settings, restricting the choice of antibiotics, and providing feedback to practitioners on local patterns of resistance.<sup>28</sup> WHO has developed guidelines for rational antibiotic use in developing countries, which can be adapted for local use.<sup>29</sup>

## The glaring immunisation gap

Only Sri Lanka has been able to sustain high levels of immunisation coverage among its children (table 3). The regional average for children receiving three doses of diphtheria, pertussis, and tetanus vaccine in South Asia is only 58%.<sup>7</sup> Only half of South Asian children receive a single dose of measles vaccine, and measles

**Table 3** Comparison of selected indicators for immunisation in children in South Asia

Characteristic	Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan	Sri Lanka
% receiving three doses of diphtheria, pertussis, and tetanus	44	69	88	64	92	72	56	99
% receiving measles vaccination	46	65	—	56	—	71	54	99
No of cases of polio in 2003	8	0	0	224	0	0	99	0

Data sources: Unicef ([www.unicef.org/infobycountry/southasia.html](http://www.unicef.org/infobycountry/southasia.html)),<sup>7</sup> and WHO Global polio eradication initiative ([www.who.int](http://www.who.int)).

eradication has not received priority attention.<sup>7</sup> Poor routine immunisation coverage is responsible for the delay in polio eradication—India, Pakistan, and Afghanistan are now among only a few countries in the world with wild-type polio (see table 3).<sup>30</sup> Good news is the recent introduction of hepatitis B vaccine in immunisation programmes through the support of the Global Alliance for Vaccines and Immunization. Future funding of hepatitis B vaccination, however, remains uncertain.

As South Asian countries struggle to immunise their children with these basic vaccines, children in industrialised countries are being protected against an increasing array of infectious agents through use of new vaccines against *H influenzae* type b, pneumococci, meningococci, hepatitis A, and varicella and other vaccines, such as against rotavirus, are soon to be licensed. Poor routine immunisation coverage and lack of access to newer vaccines have created a huge gap in immunisation between children living in industrialised countries and those living in developing countries.

**Reducing the burden of infectious diseases**

In the short term a few simple and proved interventions may reduce the number of deaths and disabilities caused by many infectious diseases. These include promotion of exclusive breast feeding, hand washing, clean water, use of oral rehydration therapy for diarrhoea, improving nutritional status among mothers and young children, better immunisation coverage including addition of effective new vaccines, provision of good antenatal care and clean delivery, and improving care seeking behaviour for serious illness.<sup>31–33</sup> Tuberculosis, HIV, and hepatitis prevention activities (for example, increasing awareness, behaviour modification, use of autodestruct syringes) should be integrated within an essential health package delivered through a strengthened public health system in the region. In this, Sri Lanka and Kerala (India) have shown the way.

**Additional educational resources**

- Unicef ([www.childinfo.org](http://www.childinfo.org))  
Information on child health and survival
- World Health Report 2003—Shaping the Future*. Geneva: WHO. (<http://www.who.int/whr/en/>)  
Information on burden of diseases
- Bellagio Child Survival Study Group, *Lancet* 2003  
Series of articles on child survival
- Information for patients**  
Children's Vaccine Program  
([www.childrensvaccine.com/html/parents\\_teen.htm](http://www.childrensvaccine.com/html/parents_teen.htm))  
Information on vaccines for parents

**Surveillance systems**

Policy planners need to make evidence based decisions for improving population health. The ability to measure disease burden, the global effort for eradication of polio, the recent outbreaks of severe acute respiratory syndrome and avian influenza in many Asian countries, and the plague scare in India show the importance of establishing sustainable and robust detection and early warning systems for infectious diseases. Eradication or control requires the ability to detect these diseases and use the information for preventing further spread. Surveillance systems for infectious diseases are, however, lacking in most of South Asia. Requirements of notification for communicable diseases are rarely enforced, and most healthcare activity takes place in the private sector—information not usually captured by the rudimentary government information systems for health management. Epidemiologists and microbiologists are not involved in disease control activities, and vital registration systems for births and deaths are absent or inadequate. Additionally, many disease outbreaks with major consequences for public health and trade, such as haemorrhagic fevers, influenza, and severe acute respiratory syndrome, require sophisticated facilities and expertise of the type available only in a well equipped national reference laboratory. As the recent outbreak of avian influenza in Pakistan's poultry population illustrates, absence of such facilities and dissemination of reliable information in a timely manner can have devastating consequences for both public health and industry.

A noteworthy success story is the recent establishment of surveillance for acute flaccid paralysis as a proxy measure for detecting poliomyelitis in developing countries. Surveillance systems do not have to be expensive. John and coworkers developed a surveillance system at district level serving over 5 million people in Tamil Nadu (India), with a per capita cost of less than one US cent per year.<sup>34</sup> The system monitors occurrence of vaccine preventable infections, meningitis, encephalitis, rabies, hepatitis, malaria, typhoid, cholera, HIV infection, and antimicrobial resistant pathogens. Major contributors towards the programme's success were involvement of staff in the government and private sector, sentinel laboratory surveillance, simple reporting procedures, and regular feedback to data providers. This concept was later extended to all districts of Kerala. Such a model of public-private sector partnership may be replicable in sentinel districts of all South Asian countries, enhancing our ability to detect and monitor the occurrence of infectious diseases important to public health, as well as to measure the effectiveness of targeted interventions.

**Conclusions**

Most of South Asia is in the early phase of an epidemiological transition where disease patterns



change from infectious to more chronic degenerative ones. Infections remain among the commonest causes of premature mortality in South Asia, and the impact of HIV and AIDS may delay the epidemiological transition. Sound governmental policies, especially adequate investments in female education and public health systems, can bring about a rapid decrease in the burden of infectious diseases in the rest of South Asia, as shown by Sri Lanka.

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**Competing interests:** None declared.

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## A memorable patient

### Spiritual relief

As healthcare professionals, we regularly encounter complex decision making with regard to patient consent. While working as a volunteer doctor in a Tibetan hospital in northern India, I came across an unusual example of difficulty gaining consent.

An elderly monk presented with a sharp thoracic back pain of sudden onset and shortness of breath. A chest radiograph revealed a large pneumothorax. This was aspirated successfully, but recurred the following day. We discussed the need for a chest drain, but the monk withheld consent, as he felt he was close to death and did not want any invasive procedures performed.

After further discussion, he conceded that he would only consent to such treatment if he could obtain a "divination" from His Holiness the Dalai Lama; it is local practice for Tibetans occasionally to seek advice and guidance from their spiritual leader. Consequently, although he remained in respiratory distress, a postal request was made for a divination. Ten hours later, the

divination was obtained, and a chest drain was inserted without complication.

This was a particularly unusual example of consent by proxy and emphasises the need to consider patients' cultural and spiritual beliefs when obtaining consent.

Sarah Hull *general practitioner, London*

Many thanks to the Tibetan Delek Hospital, Dharamsala, northern India.

We welcome articles up to 600 words on topics such as *A memorable patient*, *A paper that changed my practice*, *My most unfortunate mistake*, or any other piece conveying instruction, pathos, or humour. Please submit the article on <http://submit.bmj.com>. Permission is needed from the patient or a relative if an identifiable patient is referred to. We also welcome contributions for "Endpieces," consisting of quotations of up to 80 words (but most are considerably shorter) from any source, ancient or modern, which have appealed to the reader.